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THE VEGETATION OF THE ILLINOIS LOWLANDS.

BY PROF. GEO. H. PERKINS.

THE vegetable life of Illinois presents many points of general interest, and these are nowhere else so prominent or peculiar as over the broad, level tracks of moist land so often bordering the large streams of the West. These lowlands or, as locally termed, "bottom lands" or "river bottoms," are of very variable extent, their limits being determined for each stream by the character of the region through which it takes its course. In one part of the river they are many rods in width and follow it for miles; in another they are narrow and soon end, and again they are wholly wanting, as when bluffs come to the water's edge and form rocky or gravelly banks. This is finely illustrated in Northern Illinois, where along the Mississippi are high banks with many an outcropping cliff of Galena or Niagara limestone. These cliffs have weathered into forms so strangely like half-ruined fortresses that it is not easy to believe that yonder bit of wall, half concealed by vines and shrubs, this crumbling turret, or those broken battlements, are but rough masses of rock. In passing from the extreme northern part of the state southward, we find the hilly, uneven surface growing smoother and more like a rolling prairie, which it finally becomes, and this in turn giving place to the dead

level of the flat prairie; yet the greater part of the northern third of the state is far from level, and the river bottoms, though often extending one or two, and in some places, five miles from the Mississippi, are not infrequently broken up by highlands. Nearer the centre of the state these lowlands are wider and less interrupted in their extent. From Rock Island to Quincy, and even still farther south, for a distance of over two hundred miles, bluffs do not form the shores of the Mississippi, except at intervals widely separated and for short distances. In many places the banks are formed simply of the washed out edges of great prairies that extend for many miles into the state. Often while the banks themselves are low, at varying distances from the water the ground rises in rounded hillocks or ridges, or masses of limestone jut out above the surface and form sharp cliffs, all known under the general name "bluff." Between the bluffs and the river the ground is generally low, moist and often swampy. Such lowlands along the great river are from a few rods to ten miles in width and, of course, many more in length. Similar, though less extensive lowlands, are found along Rock River, Illinois River and other lesser streams, and along the Iowa side of the Mississippi. Not all of these river bottoms are swampy, some are reached only by unusually great freshets and are very valuable as farm lands, the soil being the richest loam, others, but little elevated above the usual level of the water, are overflowed by every rise and may be not only swampy but dotted here and there with ponds, some of which are of quite large size. Sometimes these ponds unite, retain a permanent connection with the stream and, at low water, flow towards it with a slow current, forming what are called "running sloughs." Wherever the lowlands are flooded only at long intervals, or only every spring, when the stream is at its highest level, they are usually covered with forests which are made up of trees of large size and are singularly free from undergrowth. In midsummer, after the spring floods, when the ground has dried, a carriage may be driven through these forests for miles with very little inconvenience from bushes, or indeed from any obstacle. It is not easy to imagine such forests as ever formed of *young* trees, they seem to have always been large and old and stately as now. True temples of nature are they — the ground smooth and turf-covered as if carefully prepared for crowds of worshippers — the

grandly rugged columns of oak, maple, cottonwood, sycamore and many others, reaching far up to the leafy arches of the roof—the profound silence brooding over all, call the soul to humble adoration of the great Father of all. Except the occasional chatter of a squirrel, the tremulous, half frightened twitter of a bird, or the monotonous hum of an insect, scarce a sound is heard above the rustling of leaves, murmur of wind, or creaking of interlocking branches, sounds all of them only serving to make the silence seem the more profound. Undevout and inappreciative indeed must be the heart that can resist the sombre fascination of such a place, a place where, away from life's cares and vexations, away from human influences, surrounded by majestic trees, whose huge trunks by their ribbed and seamed sides tell of centuries of growth, while their tops, green and leafy, declare that the mystery of life and growth still goes on with unabated vigor, is found closest communion and fullest sympathy with nature. But there are broad tracts too wet to afford a suitable soil for the growth of forests. In such places only groves or belts of woodland are found. These cover the higher portions of land, while all around are wide marshes covered with tall reeds, sedges and grasses, and lowest parts filled by ponds.

After the high water of spring has subsided, the ponds are bordered by a belt of mud or sand, over which crawl hosts of Paludinas, Lymnæas, Physas, and other "snails," while just below the water's edge the more strictly aquatic Unios, Anodontas, Planorbis and the like are equally abundant, so that these places offer great attractions to the conchologist.

Although I have collected fresh water shells in many localities, I have never secured so rich a harvest of some of the larger species as in some of these sloughs. And specimens are not only abundant, but of large size and with unusually bright colors. Nor are these localities less inviting to the ornithologist. Quite a number of species of birds find in them a congenial home and abundant food, ducks in the water, and plovers, herons and the like along the margins of the ponds, and in the rank growth of sedges and grasses, or the copses of button-bush which afford them shelter, many a thrush and warbler, while over all, like an untoward fate, hovers the bird of prey. Passing these attractions, interesting as they are, without further notice, let us now devote

ourselves to a study of the botanical characteristics of the region. From early summer until late autumn many a rare and beautiful flower is here seen. Perhaps the finest display is in late summer, when, over the higher borders of the marshes, where the lowland rises to meet the upland prairie, grow hosts of purple phloxes, mints, pentstemons and many other species, while here and there, towering high over all the rest, are seen superb clusters of the rose-pink *Spiræa lobata*, well called "queen of the prairie." On lower ground and in more moist soil, are several species of gerardia with rose-purple flowers, some of the more delicate being exceedingly graceful, the whole plant covered with beautifully tinted flowers, being an airy panicle of bloom. Other species with yellow flowers and of less graceful habit are found on drier ground. With these charming plants are found blue lobelias, purplish or blue veronicas, white chelone and a large representation of polygonums or knot-grasses, with flowers of crimson, rose, white or greenish hues, most of them neither very attractive nor conspicuous individually, but when growing in masses the effect is often very pleasing, and in the case of *Polygonum amphibium* even brilliant, its deep crimson wands making many a pool bright and beautiful. Much taller than these are the umbelliferæ, some species of which rival small trees in size, the white flower clusters standing seven or eight feet above the ground. Not infrequently from some darker, shadier nook flashes the brilliant red of the cardinal flower, while just above the smaller herbs, sometimes like a cloud of variegated mist, wave the panicles of purplish, yellowish or greenish grasses and sedges, the light green of the wild rice being often especially noticeable. In the water, besides many of the grasses and sedges, are found pennywort, several species of ranunculus, sagittaria, pontederia, lemna, azolla, peltandra, beautiful pond lilies, which seem to attain their largest size in this region, and many other plants of similar habit. Among these smaller species, or by itself alone, grows the great nelumbium, giant among our aquatic plants, of interest because of its kinship with the Egyptian lotus. This covers many acres, often extending for several miles in great patches. The large cream-colored corollas, standing often five or six feet above the water, are very conspicuous and attractive, as are also the leaves, their great disks, one to two feet in diameter, lying on the surface of the

water or raised somewhat above it. The upper surface of these leaves is of the most exquisitely shaded, velvety green, with which the much lighter shade of the under side contrasts in a most pleasing manner. In the fall the flowers give place to the huge conical seed cases, holding in cup-like depressions on the flat upper surface acorn-like seeds, which, in days gone by, furnished an important article of food to the Indians. Not infrequently small flocks of ducks are seen leisurely filing in graceful curves in and out of this lily forest, and more rarely a solitary blue or white heron stands dreamily gazing into the water, or lazily wings his way to the distant wood. But few song-birds are found in midsummer in the immediate vicinity of the large ponds, though more common a little way from them, and often the silence is almost as complete here as in the great forests, the only sounds, perhaps, being the harsh call of a hawk or the sudden splash of a water rat or large turtle. If a knoll or other elevated position can be gained a wild scene often lies before the observer. All around him as far as the eye can reach lies the seemingly boundless sea of waving grass, the undulating surface only interrupted now and then by rounded clumps of the glossy-leaved button-bush (*Cephalanthus*), or more rarely by the tall form of a cotton-wood or other tree, while in the far distance the sky meets the moving surface, or a belt of trees forms a dark wall which limits the view, except where there are breaks through which are glimpses of the same billowy expanse stretching on and on indefinitely.

The state of Illinois extends from north to south over three hundred and eighty miles, and for this reason would naturally be expected to produce a very varied flora, as it certainly does both as to tree and herb.

In one of his works Humboldt mentions the tropical appearance of the forests of the Mississippi valley, due to the frequent occurrence of pinnate-leaved trees, and the palmate-leaved trees add greatly to the same effect.

In many of the forests there is a very noticeable absence of the higher cryptogams, such as ferns, club-mosses and mosses. Occasionally a great profusion of these plants is seen, but often one may ride for hours through rich, damp woods without seeing altogether more ferns than could easily be held in the hand, and the bright, rich green of mossy bank or moss-covered rock or log is not

often seen. It is not improbable that the germs, or young plants of these tribes are washed away and destroyed by the often recurring freshets, especially by the spring floods, but they are absent not only from the lowland forests, but as well from those on the uplands where no freshet ever comes. Here the drouth of summer may destroy them as too much moisture does in the lowlands. If we study the trees alone we find that the entire state affords not far from a hundred distinct species and varieties, besides about one-fourth as many shrubs. It would be out of the question to mention more than a few of the more important species here. Of the maples, the sugar and the silver, or white, are abundant, and of large size, sometimes reaching a height of a hundred and fifty feet and a diameter of eight or ten feet.

The red maple so common in New England very rarely occurs wild in Illinois, so far as I can ascertain. The oaks are represented by at least fifteen species and varieties, and in many places form the greater part of the forests and in new settlements they furnish most of the building material in place of the lacking pine and spruce. Of this tribe the most abundant and widely distributed are the white, red, and black oaks. The bur, swamp and post oaks, are common in some localities, as are the pin oak, chestnut oak and laurel oak, though they do not seem to be as universally common over the state as the three species first named. The scarlet oak and Spanish oak are probably the least common, except Lea's oak which occurs in Fulton county and perhaps elsewhere. Both species of Nyssa found in the Northern States are common in Southern Illinois but not elsewhere. The pawpaw, persimmon and pecan are found more or less abundantly over the southern two-thirds of the state, the first species occurring as a second growth sometimes in considerable quantity. There are several species of trees which are found either alone or in small groups or along the edges of groves, but they very rarely form groves by themselves. Those of this class which are most commonly found upon moist ground are, the honey locust, beautiful in form and foliage, at a distance one of the most attractive of trees, but hideous often for its huge clusters of thorns; the box-elder, or ash-leaved maple, with drooping branches that in large, solitary trees sometimes almost touch the ground, and in one or two such specimens I have seen almost perfectly regular domes, the base of

each nearly touching the ground; the buckeyes, which are very beautiful trees, the black walnut, butternut, and larger than any of those mentioned, rivalling the very largest of all our trees, the sycamore and tulip-trees, and more rarely in the southern part of the state two small trees, the two species of *Bumelia* or southern buckthorn. Besides the maples and oaks some of the largest trees found in Illinois are the cotton-wood, linden, red, green, blue, white and black ash, wild cherry, the various species of *Carya*, the American and red elm and some others. Many of these trees are found of very much larger size than is common in our New England forests, especially such as grow on the bottom lands. Here maples, sycamores, cottonwoods, etc., from a hundred to a hundred and fifty feet in height, and six to ten feet diameter at the ground are not uncommon, and now and then these dimensions are considerably exceeded. Even the sassafras, which in New England is a small tree, sometimes grows to a height of seventy feet. This species I have seen spring up as a second growth and so completely cover several acres as to exclude almost every other tree or shrub. The willows are well represented all over the state, though I have never seen them covering very wide tracts, as in some parts of the country. Both on the lowlands along the borders of small streams, and on the upland prairies the wild plum is common, and in similar localities clumps of wild apple are found. Both of these trees are very beautiful when in bloom, especially when together, the pure white of the plum and the pink of the apple blending finely while the delicious fragrance of the latter perfumes the air far and near. The birch, so commonly found in New England woods, is rarely found in Illinois, and only one species, the red birch, is found at all. Evergreens, which constitute so marked a feature in many landscapes, are often wholly wanting in Illinois scenery. The red cedar is found sparingly in many parts of the state, and on rocky ridges in the Northern counties the white cedar grows. Sometimes, too, the white pine and dwarf juniper are seen. One more species completes the list of coniferæ, the bald cypress, which grows along the Ohio and Mississippi, in the Southern counties where it occupies great swamps, its straight trunk towering for a hundred and fifty feet above the ground. This tree is very valuable for timber, though from its habits and

place of growth it is not as easily obtained in large quantities as trees growing in drier soil, and without its sometimes almost impassible barricade of roots, arching and twisting above the surface of the swamp, and amid these the massive trunks of fallen trees.

Grand indeed are many of these old trees in their rugged bark and the green and gray of moss and lichen, while some are not only grand but very beautiful as they are overhung with delicate or heavy arabesques of clinging vines that sometimes hide completely the rudeness of their support, and sometimes but partly cover it, while making that which is not concealed all the ruder as it contrasts with their own grace. There are many more species of twining plants and vines growing wild in Illinois than in New England, and, as with the trees, so with the vines, our familiar friends are so large and luxuriant that we scarcely recognize them. The poison ivy, Virginia creeper, or woodbine, and wild grape are all found there and are largest of the vines. They often completely cover, not only the shaft of a tree, but its top as well, sometimes so tightly embracing their support as to destroy it. They reach the very top of the highest trees, and are found with stems a foot or more in diameter near the ground. Not always do these climbers cover and destroy green and living trees, often their fullest beauty is reached as they drape the naked, seared trunk from which life has long since gone, thus changing the unsightly and uncouth into noble shafts of living green. Besides these giant vines there are many smaller and more delicate. Some of these, as the wild yam, moonseed, hop, four or five species of smilax, or greenbrier, and other allied forms which are beautiful for the green of their foliage and attractive mode of growth, but with inconspicuous flowers, fill many a thicket with masses of tangled cords. Others have the double beauty of foliage and flowers, the grace of pendant branch and twining stem being completed in the more splendid charm of clusters of flowers. Chief of these, as it is chief of all our native vines, is the Wistaria, found native in Southern Illinois. Superb is this vine when of large size and in the full glory of bloom, the large clusters of rich purple flowers hanging thickly over the soft green of the leaves. Yet more showy, though less elegant, is the Bignonia, or trumpet creeper, as its clusters of orange buds and flowers gleam like some bright

fruit from amid the branches of a tall tree or, unexpectedly flash out from the interlacing branches of the thickets in which it loves so well to grow. Less showy climbers and of smaller size are several species of clematis, the wild passion-flower, cypress, morning-glory, and all the rest, each with its own peculiar beauty of flower or leaf, sometimes growing alone, sometimes intertwined about the same tree with several others, uniting their various hues, the charms of each brightened by those of the others and all forming a variegated, harmoniously tinted mass delightful to see. In the dreamy midsummer when all nature's influences incline to reverie and repose, no place can be more fascinating than the wild regions of which we have been speaking. More than elsewhere in the shaded walks of the ancient forests, is there a coolness and freshness most grateful to the body, and a freedom from care, a retirement and a restfulness, as grateful and soothing to the mind. Not those who have flitted hither and thither over the railroads of the West, not even those who have sailed on its great rivers, have an adequate idea of the peculiar modes in which nature expresses herself in those regions, but only to those who have, alone and on foot, wandered for miles and miles amid the forests, over the plains, through the marshes, held by the love of nature, is it given to know her in her friendliest moods.

THE POTTERY OF THE MOUND BUILDERS.

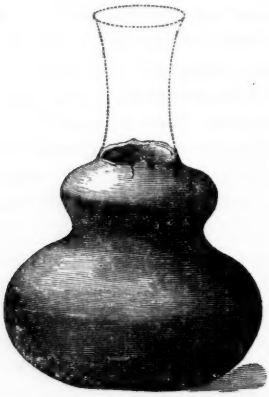
BY F. W. PUTNAM.

[Concluded from June Number.]

Nos. 7759, 7760, 7787, 7788, 7789, 7790, 7791 and 7792 are water jars of various sizes and shapes, as shown in the four figures illustrating this group. 7759 differs from the others by being constricted in its upper portion. The neck of this jar is not preserved, but was probably like the restoration given in the figure. The diameter of greatest bulge of this vessel is from 6 to 6·2 inches. The constricted portion is about 3·3 in diameter, and the upper bulge is ·5 of an inch more than the constricted part. The present height (without the neck) is 5·5 inches.

No. 7786 is remarkable for its flatness, the whole jar being 6·8 in height, but one-half of this is in the length of the neck. This jar is also much flatter at its base than any of the others,

No. 7759.



and has its greatest diameter 2·5 inches from the bottom where it measures 6 inches. The upper part of the neck is 2·3 inches in diameter.

No. 7787 is the most perfect in finish and symmetrical in form,

No. 7787.

No. 7788.

with a small sized neck. This jar is 8·3 in height, and has its greatest diameter 6·4 inches from the bottom.

No. 7788 has a diameter of 7 inches and is 8·5 inches high. No. 7790 is 6·5 high by about 4·9 in diameter. No. 7792 is the smallest and most rudely made: it is 3·5 high by 2·9 in diameter. Its neck is 1·8 long and the diameter of the mouth is about 1 inch. Nos. 7739, 7740, 7753, 7757, 7758, 7793, 7794, 7795, 7796, 7797, 7798, 7799 are all spherical vessels with short necks and moderately sized mouths and are of various sizes. Nos. 7753, 7795, and 7798 are figured and show the variation in the pattern.

No. 7792.

No. 7753 differs from the rest in having been colored red, and in having the bulging portion slightly indented so as to divide the sides into four slightly marked portions.

No. 7753.

No. 7740.

This vessel is 3·3 inches high, 4 inches in its greatest diameter, and 2·4 across the mouth which has a slightly turned lip.

No. 7740 is of similar shape and size to this, but has the surface divided into six projections instead of four. The lips of this are broken.

No. 7798 is not as well made as the others, the clay not having been so well burned, and it is lighter in color, probably from

No. 7795.

No. 7798.

that fact. It is one of the smallest of the collection and the neck is without a turned lip. It is 3·6 inches in height by 3·4 in diameter.

No. 7795 is a nearly symmetrical vessel, made of the fine clay of which many of the articles are composed. It is 6·8 to 6·9 inches in its greatest diameter, 6·9 inches high, and 3·4 across the mouth. This vessel is slightly flattened at its base.

No. 7794 is the largest of the series, and is from 8·1 to 8·3 in diameter by 7·8 inches in height.

Nos. 7741, 7742, 7752 and 7754 are small vessels of the shape shown in the figures. 7742 might, from its finish and shape, be well classed as a drinking cup. It is 2·9 inches in height by 3·6 in greatest diameter, and about 3 inches across the mouth, the lip of which is slightly ornamented by small oblique lines cut in its inner border.

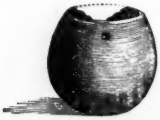
No. 7741.

No. 7742.

No. 7741 is not as symmetrical a vessel as the last mentioned, and has considerably thicker walls. It is about 3·6 inches high and about 5·3 in diameter with an uneven mouth about 3·5 inches across.

No. 7754 is a roughly made little cup, quite thick and only partially baked, about 2·6 inches high and with its greatest diameter equal to the height.

No. 7752.



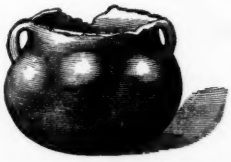
No. 7754.

No. 7752 is another small cup about the size of 7754 but more spherical in shape and having a hole near its mouth, as shown in the figure. The opposite portion of the mouth is broken, but it is probable that a corresponding hole existed there, and that these

holes were for the purpose of suspending the cup. This perforated cup naturally leads to the next group of vessels, or pots with handles, of which class there are several of various sizes, with slight variation in finish and ornamentation.

Nos. 7763, 7778 and 7780 are the three largest pots, and are without ornamentation. Nos. 7763, and 7778 have the surface divided into six even portions by slight depressions. Nos. 7780 and a smaller pot, No. 7779, are perfectly plain and with even surfaces. No. 7767 is a smaller pot, of the character of 7763, with its surface divided into six portions. No. 7769 is a small vessel,

No. 7767.



No. 7770.

smooth on its sides, but with its lips marked by small oblique lines cut in the clay. No. 7770 is ornamented by a row of small depressions, as if made with a pointed stick while the clay was soft. No. 7771 is a little more elaborate in its ornamentation, the punctures extending down the sides in groups which are enclosed in lines cut into the clay. By the side of the figure of this pot is placed a figure of one of somewhat similar ornamentation, but which does not seem to be now with the collection, unless in fragments.

No. 7771.

No. 7800 is a large pot (now in fragments) ornamented in a

similar manner, but with the addition of small bunches of clay forming the bases from which the ornamental arches are sprung.

No. 7800.

The design on this vessel is carried out quite symmetrically.

No. 7772.

No. 7772 was evidently designed to represent the face of some animal in relief on one side of the pot, as shown in the figure; a portion of this face is on a missing fragment. The distance between the handles on the opposite side is marked off by four arches of double lines.

Nos. 7762, 7765 and 7766 are plain pots with four handles like

No. 7762.

No. 7773, and others from the Big Mound. No. 7766 is the smallest pot in the collection. No. 7765 is remarkably thick and heavy, weighing 2 pounds and 14 ounces, while 7762, of very nearly the same size, weighs but 1 pound 15 ounces.

No. 7768 is a small pot with eight handles. These handles extend from the lip to a projecting ridge round the pot as shown in

No. 7766.

No. 7768.

the figure, and this ridge is ornamented by vertical lines, evidently made with the thumb nail while the clay was soft.

The following table gives the dimensions of these several varieties of pots with handles:

No. 7763.	Height	6	inches;	greatest	diameter	8	inches.
" 7762.	"	5·8	"	"	"	7·7	"
" 7765.	"	6	"	"	"	7·3	"
" 7800.	"	6	"	"	"	8	"
" 7780.	"	4·1	"	"	"	6	"
" 7778.	"	4·2	"	"	"	6·1	"
" 7768.	"	3·6	"	"	"	4·6	"
" 7769.	"	3·6	"	"	"	4·6	"
" 7772.	"	3·7	"	"	"	4·4	"
" 7767.	"	3·2	"	"	"	4·6	"
" 7771.	"	3·2	"	"	"	4·2	"
" 7770.	"	3·2	"	"	"	4·3	"
" 7779.	"	3·2	"	"	"	4·4	"
" 7766.	"	2	"	"	"	2·7	"

No. 7777 is a vessel transitionary in form between the pots with two handles and the wide open vessels with two knobs. It agrees with the pots like No. 7800 in shape, but is provided with two flanges or knobs from the lip like No. 7715. It is four inches high, 5·8 in diameter at its bulging portion and four inches across its mouth.

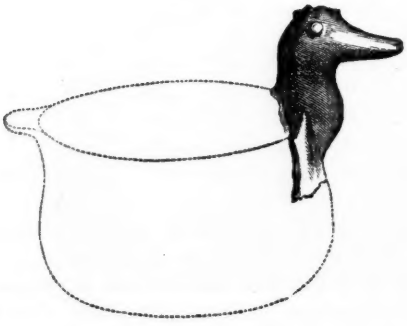
Nos. 7715, 7720, 7733 and 7737 are all of the same character, but of various sizes and depths, and are of solid make. No. 7715 is the best finished and most symmetrical of the lot, and also the smallest, being but 2·4 inches in depth by 3·6 in diameter across its mouth which is its widest part. No. 7733 is 2 inches high and 4·5 in diameter. No. 7720 is 2·7 high by 4·6 in diameter. No. 7737 is of the same height as the last, but measures 5·2 in diameter.

No. 7715.

No. 7717.

Of the same character of vessels with those last described are the "head dishes," in which one of the knobs is made in the form of the head of some animal, or represents the human head, more or less perfectly moulded in the clay. No. 7717 is the most rude attempt to represent a bird's head, and is similar to that from the Big Mound figured under No. 7824. Nos. 7714, 7718 and 7719 are unmistakable representations of the heads of ducks. No. 7723 has

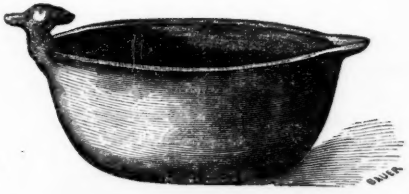
No. 7814.



the head of some animal with large ears, and differs in shape from the others in having the sides of the vessel turned inward

at the mouth, while all the others are wider at the mouth than in any other part. Of 7716 and 7818 only the heads are now

No. 7718.



preserved (unless the rest of the vessels are among the fragments that have not yet been restored). No. 7730 has a well

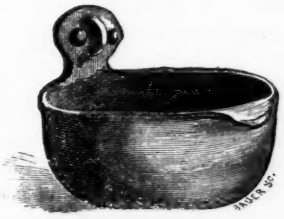
No. 7719.

No. 7723.

designed human head which was evidently made in two pieces and put together before the vessel was baked. In this the hair

No. 7716.

No. 7818.



is represented as carried over the top of the head and down its back in the form of a narrow braid. The eyes, mouth and ears are perforated so as to open into the hollow of the head. It will

be noticed that in all the instances where the human head is represented the face looks into the dish while all the birds' heads, and the head of the mammal, look outwards. (No. 7717 has the appearance of looking into the dish, but this rude head has a

No. 7730.

portion broken from the outside which probably would have better represented the bill of a bird pointed that way.)

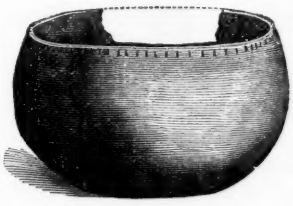
The several most perfect of these head dishes measure as follows, the first figure representing the height, and the second, the diameter, across the opening: No. 7730, 4·7 by 9 inches; No. 7718, 3·8 by 8·5 inches; No. 7717, 3·5 by 7·6 inches; No. 7719, 4·2 by 7·6 inches; No. 7716, 3·2 by 6·8 inches; No. 7743, 3·1 by 7·8 inches; No. 7723, 3·1 by 3·5 inches.

Col. Foster, on p. 246 of his work (reproduced here on p. 407), figures a "drinking cup" from a stone grave in Perry County, Mo. This cup is of the same design and pattern as No. 7730, and it may not be venturing too much if we conclude, from this very peculiar form of pottery, that the same race made the article found in the ancient cemetery of Perry County and those found in the mound in New Madrid in the same State. If this should be substantiated by further evidence we shall have the means of identifying the general cemeteries of the moundbuilders, or, at least, of that particular race who erected the mounds of the southwest. It has long been urged that the moundbuilders must have had other depositories for their dead than the mounds themselves, for, as numerous as the latter are, they do not often contain more than

one or two burials and hence they are not sufficient in number to serve as the only places of burial used by the race which must have been so great in numbers.

Nos. 7731 and 7732 are two very interesting circular dishes with low bulging sides, on two opposite portions of which the front and hind parts of animals are represented in relief, the wide mouths of the dishes occupying the position of the backs of the animals. No. 7731 has the projecting and upward turned head of a turtle with the front legs on its sides, while the hind legs are represented on the opposite portion. This dish is 2·9 high and 4·5 inches in diameter across the opening. No. 7732 is 3·7 inches high by 4 inches in diameter, and has a representation of a frog as the other has that of a turtle. Nos. 7817 and 7821 are probably portions of similar dishes representing other animals.

No. 7735.



Nos. 7735 and 7736 are circular shallow dishes with rounded sides. No. 7735 is 4 inches high by 6·4 in diameter across its mouth. The outside of the edge of this dish is ornamented by notches cut in the clay. No. 7736 is 5·4 in diameter and 3·3 high. It has the sides more rounded towards the mouth than is the case with the other, and has two deeply cut grooves around its open margin.

No. 7736.

No. 7746 is a very thin and symmetrical dish, nearly flat on its bottom, with flanging sides. It is 3 inches in height by 5·1 inches in diameter, and without ornamentation. No. 7724 is a larger dish of similar shape, but thicker. The height is the same as the last, but its diameter is 8·2 inches.

No. 7746.

Nos. 7721, 7722, 7725, 7726 and 7734

are basin-shaped dishes of various sizes and with slightly ornamented edges, as shown in the three figures.

No. 7722.

No. 7726.

No. 7725.

No. 7721 is 8·4 inches in diameter by 3 inches in height.

"	7722	"	9·8	"	"	"	"	5	"	"	"
"	7725	"	8·7	"	"	"	"	3·7	"	"	"
"	7726	"	7·6	"	"	"	"	2·7	"	"	"
"	7734	"	5·1	"	"	"	"	1·8	"	"	"

No. 7728 is a similar dish, but without ornament on its edges, and is 7·2 in diameter by 3·5 in height.

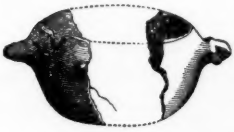
Nos. 7727, 29, 38 and 44 are saucer-shaped dishes, perfectly plain and all about 2·5 inches in height and of the following diameters, 6·8, 7·8, 8, 8·1 inches.

The last perfect specimen of these interesting earthen vessels from this mound is the peculiar cup here figured under No. 7756. It is 2·4 inches high and 2·5 in diameter across its top, by 1·6 inches across its flat base. Its concave portion is ·6 of an inch in its centre. This singular article has the appearance of having been worked into its shape entirely by pinching out a mass of plastic clay with the fingers, and it seems to have been hardened by fire only in its cavity, as if hot coals had been held in it.

No. 7756.

No. 7815 is in fragments, but the figure conveys an idea of its character.

No. 7815.



Among the numerous fragments of vessels of various shapes, the following are specially interesting: No. 7828, portions of a small vessel that stood on three short spherical hollow legs. This vessel is ornamented with stripes of red. No. 7755 is, probably, a leg of a similar vessel but of a larger size and not colored. No. 7826 consists of fragments of shallow dishes, colored red. Nos. 7802 and 7808, probably portions of the same vessel, represent a pot, of about the shape of No. 7762, that had evidently been used to hold the red paint with which several of the articles were colored.

This last cut was received with the collection, but the vessel which it represents is either among the fragments and beyond recognition or was not received with the rest of the specimens.

Prof. Swallow concludes his account of the mounds he examined about New Madrid as follows:—

"These mounds appear very ancient. Soil has formed on them to the depth of three feet. The largest trees grow on them and the connected embankments, or levees.

"A sycamore twenty-eight feet in circumference three feet above the ground, a black walnut twenty-six feet in circumference, a *Quercus falcata* seventeen feet, a white ash twelve feet, and a chestnut oak eleven feet in circumference were observed on these mounds and accompanying embankments.

"The six feet of stratified sands and clays formed around the mounds since they were deserted, the mastodon's tooth found in these strata, and other facts indicate great age. These six feet of thin strata were formed after the mounds, and before the three feet of soil resting alike on the mounds and on these strata.

"There are numerous mounds in this Swamp country. I saw one in Pemiscot county thirty-five feet high, elliptical (longer axis N. and S.), one hundred and ninety-five feet long on top and one hundred and fifty feet wide. This mound is part of a large system of

earthworks; there is a square about one thousand feet on each side surrounded with a line of earthworks or embankments several feet high, and the whole area is filled in about ten feet. In the area are two mounds, the one above mentioned and another smaller, fifteen feet high. There are also several basins in the area, circular and much depressed, and a canal on the south side of the square, fifty feet wide and twelve feet deep. The large mound mentioned was cracked open by the earthquake, as was very obvious when I visited it.

"Col. J. H. Walker, who was a youth of sixteen years at the time of the earthquake, showed me the mound in 1856, and also many large cracks produced by the earthquake. One of these cracks ran through this large mound. Col. Walker told me:—This crack was opened by the severe shock of Dec. 11, 1811. It made a wide gap through the mound from top to bottom. He [Walker] went into it and saw at bottom about twenty feet of bones, some human, some fish, and some of other animals. Above the bones was a coat of plastering made of clay, cane and grass from five to thirteen inches in thickness. Col. Walker was a leading man in that country, well known all over the state, and was deemed very reliable."

From Foster, page 246.

"Drinking Cup," one-fourth natural size, from Cemetery in Perry Co., Mo.

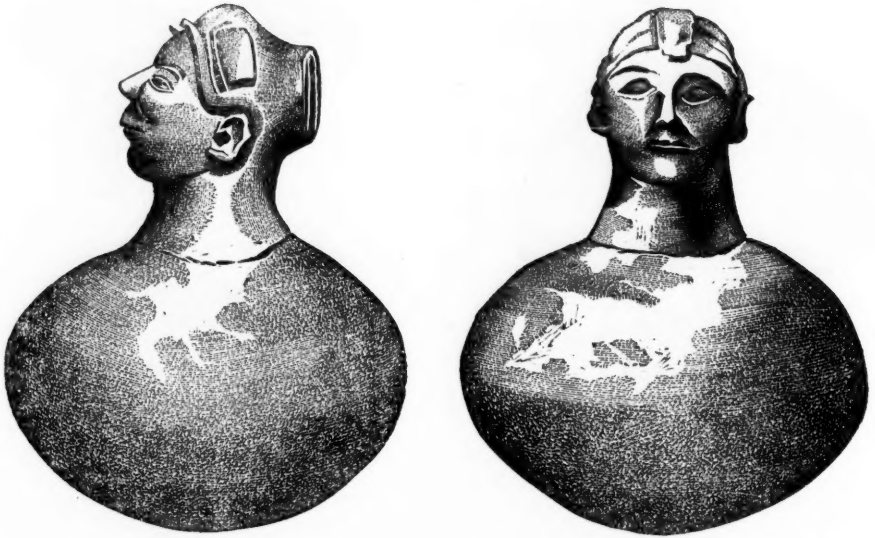
From Foster, p. 237.

"Water-coolers, eight inches high, from Cemetery in Perry Co., Mo.

From Foster, p. 243.

"Water-jug," one-half natural size, from near the mouth of the Wabash.

From Foster, p. 239.



"Water- Jugs," eight and one-half inches high, from a mound near Belmont, Mo.

From Foster, p. 240.

"Statuette" eight inches high from a mound near Belmont, Mo.

ARCHÆOLOGICAL EXPLORATIONS IN INDIANA AND KENTUCKY.[1]

BY F. W. PUTNAM.

THE following abstract of a special Report, made to the Trustees of the Museum conveys a general idea of the articles obtained and the conditions under which they were collected. Facilities were extended, in the explorations in Indiana, by the State Geologist, Professor Cox. While in Kentucky my connection with the Geological Survey, under Professor Shaler, secured extra facilities for the explorations there.

Several stone implements were collected from within the walls of the ancient stone and earth fortification on the Ohio River, near Charlestown, Indiana. This fortification has been described in detail by Professor Cox in his last Annual Report as State Geologist of Indiana, and consists of very extensive walls of stone laid without cement. At one place, on the side facing Fourteen Mile Creek, the wall is about seventy-five feet high, extending for some distance and filling a gap in the natural precipice on that side. Several fragments of flint arrowpoints were picked up within this enclosure, and Capt. Sam. C. Rucker, who lives near the fort, presented me with a few perfect implements he had found within the walls.

Another similar fortification was examined at Deputy, Indiana, and will be fully described by Professor Cox, in his next Report. The principal wall here was several hundred feet in length and was doubtless, originally, several feet in height. A singular stone mound, or monument, was also examined near Lexington, Indiana, but nothing that could be brought away was found at either of these last mentioned places. A large Refuse Circle, about four hundred feet in diameter, near Lexington, Indiana, proved to be unlike anything I had seen before, and from the abundance of split bones of animals, fragments of pottery, etc., found in the narrow ridge forming the circle, one can but consider this ridge as forming the outline (perhaps the inside of a stockade) of an

[1] Reprinted from the 8th Report of the Trustees of the Peabody Museum of American Archæology and Ethnology, 1875.

ancient camp. Fragments of pottery, with bones of deer and other animals, were collected.

Numerous stone implements of various kinds, found about Charlestown, Indiana, were secured. Several of these were kindly given me by Mr. F. M. Runyan, of Charlestown.

A collection of stone implements was made at Grayson Springs, Kentucky, and vicinity. One very interesting moundbuilder's implement of the class generally known as "plumb-bobs," and made of magnetic iron, beautifully polished, was given to me by Mr. Chas. J. Adams of Grayson, though it was said to have been found "in a coal mine" on Green River. To Mr. Adams I am also indebted for several other stone implements from various localities.

The most important exploration in Grayson County, Kentucky, was that of the Rock Shelter near Grayson Springs. This was an overhanging ledge of rock, and on the shelves of rock and in the soil below them, were found several bones of animals, as well as a few flints, fragments of pottery, charcoal, etc., and two mortar holes were noticed cut in the solid rock. A large number of bones from this place are interesting in showing the manner in which they have been gnawed by rodents.

Several caves in the vicinity of the Mammoth Cave were explored, and important results obtained. So little is known of the use of caves in the United States, either for purposes of burial or as habitations, that every opportunity was taken for their exploration.

Sanders' Cave in Barren County, Haunted Cave in Edmonson County, and a dry (unnamed) Cave in Hart County, are probably to be classed only as burial caves. Of these, Haunted and the dry Caves had been much disturbed, and many human bones had been carried away by the residents in the vicinity. Haunted Cave had also received attention from other members of the Kentucky State Geological Survey, earlier in the year; still a number of human bones and two crania were obtained from these two caves in which the bodies had been buried with care. In Sanders' Cave (owing to its difficult entrance this cave has seldom been visited) many skeletons are to be found, but the cave has received the washings of a farm, and its filthy and wet condition renders investigation rather unpleasant, and the bones hard to secure in a perfect state. In this cave the bodies seem to have been placed at one time, and from two stone arrowheads, found among

the ribs of one of the skeletons obtained, there is some ground for the belief that it may have been the burial place of the victims of a battle on this "dark and bloody ground." Further study of the crania, however, will be necessary in order to determine the race to which they belong. Several crania, a number of other parts of human skeletons, and numerous bones of animals were obtained from this cave. The crania are all of the same character, having quite flat frontal bones and a deep depression just back of the coronal suture, and they are quite different from those of the dry caves, which are high and full in the frontal region. The tibiæ in both lots show various degrees of flattening.

That some of the caves were used as places of, at least, temporary residence, was conclusively shown by my exploration of Salt Cave, which proves important in revealing a new phase in American archæology. This cave, in many respects, approaches the Mammoth Cave in the size of its avenues and chambers. Throughout one of the principal avenues, for several miles, were to be traced the ancient fire-places both for hearths and lights. For the latter purpose, small piles of stones were made with a hole in the centre of the pile to receive the bundle of dried fagots perhaps smeared with grease. Bundles of these fagots, tied up with twisted bark, were found in several places in the cave; and canereeds, probably the remains of ancient torches of the same character with those found in the Mammoth, Short, and Grand Avenue Caves, were also very abundant.

The most important discovery in this cave, however, was made in a small chamber, about three miles from the entrance, first noticed by my guides, Messrs. Cutlip and Lee. On the dry soil of the floor were to be seen the imprints of the sandalled feet of the former race who had inhabited the cave, while a large number of cast off sandals were found, neatly made of finely braided and twisted leaves of rushes.

A number of other articles were collected here, and were as follows: a small bunch of the inner bark of some tree, evidently prepared for use in the manufacture of an article of dress; several small lots of bark not quite so fine as that composing the bunch; a piece of finely woven cloth of bark, over a foot square, showing black stripes across it where it had been dyed, and also specially interesting in exhibiting the care which had been taken in darning, or mending a portion of it; a small piece of finely made

fringe or tassel discovered in one of the places where the earth had been disturbed; several fragments of large gourds; and two perfect flint arrowheads. Human excrements of great age and showing peculiar habits of life were noticed in numbers; and in several places the soil looked as if burials had been made and the bodies afterwards removed. No human bones were discovered, and the only remnants of articles that we noted indicating any kind of food were a few very much decayed shells of river muscles. A piece of shell of a Unio with a hole bored through it was also found. It is needless to add that everything in this interesting collection which it was possible to bring away was secured, though exposure to the outside air is very detrimental to specimens of vegetable substance so long preserved by the peculiar atmosphere of the cave, and it was only by thoroughly soaking the sandals, cloth, etc., in thin glue and mounting them between glass that I have succeeded in preserving them.

The braided sandals and woven cloth, together with the large gourds which were probably cultivated, and the absence of the bones of any animals used for food, are perhaps indications of an agricultural people dependent on their fields, rather than of a hunting nomadic race. In connection with these cave explorations I may add that I had the opportunity of obtaining the true history of the so-called "American Mummy" which was said to have been found in the Mammoth Cave about the year 1813, and about which so much was written soon after that time. The body was found in Short Cave, about eight miles from the Mammoth Cave, and I examined the spot from which it was taken. Since my return I have examined this most important relic, which is now in the collection of the American Antiquarian Society in Worcester.[1] A careful comparison of the fabrics and articles found in Short Cave with those collected in Salt Cave conclusively proves their identity, and thus throws some light upon the race that made use of the caves for burial places, and gives us the means for the association of the osteological character of the race as determined from this body with articles found in Salt Cave; while from several peculiar conditions of the burial in Short Cave, hints bearing on the great antiquity of the race are given.

[1] For a detailed account of the cave burials and a more extended presentation of the present paper, see Proceedings of the Boston Society of Natural History, Vol. xvii, p. 314.

A large group of mounds was visited at Pageville, Munroe County, Kentucky. This group consisted of two mounds of about one hundred feet in diameter, and from twelve to fifteen feet high, and a number of smaller mounds about fifty feet in diameter and from three to five feet high. The group lies between Barren River and Peter's Creek, on the homestead of Gen. Joseph H. Lewis, who accompanied me to the spot. A large number of stone implements, undoubtedly made by the moundbuilders, have been found about these mounds, which are now mostly covered by corn-fields. I collected fragments of pottery on the surface. One of the small mounds was opened, but it only showed that a long continued fire had been kept on its top, burning the clay to the depth of several inches. A hole was then dug to the bottom, in the centre of one of the large mounds, yet nothing that could be considered as an undoubted relic of the moundbuilders was found. About three feet from the surface a human skeleton was taken out, though it was probably an intrusive burial by a later race than the one making the mound.

About one-eighth of a mile to the south of these mounds, on the brow of a hill, were found a number of graves of a peculiar character. Many of these graves have been ploughed over, and the human bones from them whiten the field for half an acre in extent. Two of the graves, however, had not been disturbed, at least below the surface, as their walls had been made of slabs of limestone of such size as to prevent the plough from passing over the spot. These graves were nearly circular, between four and five feet in diameter and about three deep. One was carefully opened and its contents taken out. These consisted of portions of fifteen human skeletons and a fragment of pottery. The bones and teeth showed that the bodies buried were those of persons of various ages, from three children, who had not lost their first set of teeth, to one person of old age. The grave had been formed by digging a hole nearly circular and about three feet in depth. Slabs of limestone, about three feet long and from one foot to two feet wide, brought from some distance, had then been placed on end around the hole, and the bottom had been carefully covered with thin shale brought from the creek a quarter of a mile away. The bodies of the adults had evidently been arranged in a sitting posture against the upright slabs and all at one time. Only fragments of the skeletons of the three children were found and the

position in which they had been buried could not be determined. The earth had been thrown over all and a few small flat stones placed above. The fragment of pottery found was near the surface and may indicate that vessels, and perhaps other articles, had been placed on the surface over the grave, and not buried with the bodies, as is more commonly the case.

This class of graves is unlike anything heretofore described, so far as I am now aware, and while it is quite different from anything of which we know among the Indian tribes, it is equally distinct from the burial customs of the moundbuilders so far as at present known. The close proximity of the group of mounds, the extreme care and labor with which the graves had been made, their large number at this place (nearly thirty could be traced, and a very large number must have been entirely destroyed by cultivation of the land over them), and the fact that a number of bodies of various ages were enclosed at the same time in one grave, give occasion for much speculation.

Seven of the crania from this grave were obtained in such condition as to permit of their comparatively perfect restoration, and all the bones found in the grave were brought home, though they were in the last stages of decay, and it was necessary to saturate all with glue in order to preserve them in their present condition.

The several crania obtained from this grave vary somewhat in shape, yet they are, in general, remarkable for their shortness and great parietal width. They all show an occipital flattening which in one skull is very marked. A study of these crania has not been made, but while they resemble the short and high skulls of the moundbuilders, they seem to have some peculiarities not noticed in the few mound skulls I have examined. The long bones of the skeletons indicate a race of ordinary height, though the massiveness of the bones is, perhaps, above the average. The tibiæ are all decidedly flattened, and the femora are, perhaps, slightly more curved than is usual. But on all these points further study is necessary.

REVIEWS AND BOOK NOTICES.

CHEMICAL AND GEOLOGICAL ESSAYS.[1]—The manifest tendency of modern scientific researches and investigations is toward a unification of the sciences, and the volume forming the subject of this notice is a decided step in that direction. We have many and excellent text-books of geology as studied from the standpoints of physics and biology; but, with the exception of Bischof's treatise on chemical geology, which appeared nearly a generation ago, this is the nearest approach to a complete exposition of the intimate relations and interdependence of geology and chemistry which we have seen.

The work comprises twenty of the author's chief scientific memoirs, which have been published at different times during the past twenty-five years. They treat of questions in chemistry, and chemical and dynamical geology, and, to quote from the preface, "cover nearly all the more important points in chemical geology." The author says further that his researches and conclusions as developed in these memoirs "have been connected with the hypothesis of a cooling globe and with certain views of geological dynamics, making together a complete scheme of chemical and physical geology, the outlines of which will be found embodied in Essays I to XIII." Essays XIV and XV are chiefly historical, while the five brief papers which conclude the volume are devoted to the discussion of questions in theoretical chemistry and mineralogy.

In addition to the development of his own ideas, Dr. Hunt has in general given us the results achieved by his co-laborers, so that the work is in truth a fair representation of the present state of the science. Several of the more recently developed of our author's views, as those concerning the use of lithologic data as a basis for chronologic distinctions, and his theory of cycles in sedimentation, have not been generally adopted. The chemical and mineralogical data forming the basis of these hypotheses, however, may be accepted without question, and thus every reader is enabled to form an intelligent judgment concerning the truth of these hypotheses.

Essay XV on the "History of the names Cambrian and Silurian

[1] Chemical and Geological Essays, by Thomas Sterry Hunt, LL.D. 12mo. pp. 489. Boston, 1874. J. R. Osgood & Co.

in Geology," is a very valuable contribution to the history of the science; and its value will increase with time. It throws a flood of light on points of great perplexity for the student; and Dr. Hunt has in writing it, done the science a real service. It is the first complete recognition of the claims of Sedgwick, from the pen of one well qualified to write the history of that painful controversy, and it is to be hoped that the time is not very remote when geologists will generally refuse to recognize the unwarrantable usurpations of Murchison.

Some little repetition has arisen from printing the essays in their original forms, but this could not be avoided, since the author wished to preserve a certain historic value which attaches to the papers, and which would have been lost by a change of forms and dates.

A copious index and table of contents add much to the usefulness of the work.—W. O. C.

CHECK LIST OF NORTH AMERICAN FERNS.[1]—This is a very neatly gotten up 8vo pamphlet, printed on excellent paper on one side of the sheet so as to admit of its being cut for herbarium labels. The specimens are numbered with the same numerals, and the nomenclature substantially agrees with that of Horace Mann's catalogue. I submit a few criticisms on Mr. Robinson's work. "3677^a Notholæna Newberryi, Eaton, n. sp." The letter following a duplicate should be *b*, the letter *a* being commonly understood as applicable to the first occurrence of a number or name. "D. C. Eaton is given as the authority to other species, the inference being that there are two Eatons, both fern authors, whereas there is but one, the well known New Haven Professor. All herbarium labels and catalogues also for that matter, should have the reference as well as the author. If the original work be not accessible to the compiler then let the reference be to the work from which he quotes. Such a course clears up doubts, prevents blunders, and would here have been particularly useful in the cases of Prof. Eaton's new species. No European author quotes "3763 *Woodsia obtusa* Torrey" (always Hooker), for the reason that his catalogue, published in 1840, is unknown there, and is never quoted in American floras. If Mr. Robinson had referred to the *Synopsis*

[1] Check List of the Ferns of North America north of Mexico; by John Robinson.—Naturalists' Agency, 1873. 8vo. pp.

Filicum he would not have written "3780 *Botrychium virginicum* Swartz, that author and his predecessor Linné having written *virginianum*. It is difficult to understand upon what principle author's names have been attached to varieties. "*Aspidium aculeatum* Var., Braunii, Koch" may be correct so far as it goes, as correct as if Mr. Robinson had attached Eaton's, A. Wood's, or his own name as the authority, but a reference to Koch's flora would have shown that that author simply quoted Döll who reduced Spinner's *A. Braunii* to a variety of *A. aculeatum*. So also of "*Aspidium spinulosum* Var., *dilatatum* Gray," the fact (if I may use the word in this sense) was published by Roth in 1797, and the name by Hornemann in 1827. In two other cases Mr. Robinson has gone to the opposite and more misleading extreme, "*Aspidium cristatum* Var., *Floridanum* Hooker," and "*Aspidium spinulosum* Var., *intermedium* Willdenow." These authors described the plants as good species; Professor Eaton reduced them to varieties, and should have been quoted as the authority in accordance with the "laws of botanical nomenclature" adopted by Mr. Robinson.

3745c. Var. *Boottii* is the correct orthography, the plant having been named by Prof. Tuckerman after the late Mr. William Boott. The arrangement of *B. Ternatum* is not Swartz's, and scarcely Milde's. The latter author combined three Swartzian species *rutaceum* Svensk. Bot. t. 372, fig. 2), *lunarioides* and *ternatum* under Thunberg's oldest name thus—

"*Botrychium ternatum* (Thunb.)" "Milde Monog. Botrych. p. 146 in Z. V. B."

"*A. Europœum*" (Rabenhorst, No. 80). I have numerous American species of this variety, the *B. rutæfolium* A. Br.

"*B. Australasiaticum*" (Kunze t. 155; Hook. Fl. Tasman. t. 169). This is the true ternatum and is not N. American so far as I have seen.

"*C. Americanum*" "a. lunarioides (Michx. sp.)" b. obliquum (Menhl. sp.)" "g. dessectum (Menhl. sp.)"

Bernhardi's so-called genus Allosorus is here dropped in favor of Cryptogramme; Prof. Eaton would have done well to have sent Cystopteris into limbo with it. Where space abounds author's names need scarcely be contracted.

We trust Mr. Robinson may find it necessary soon to issue a second edition. — D. A. WATT.

BOTANY.

THE LAW OF EMBRYONIC DEVELOPMENT IN ANIMALS AND PLANTS. — An article upon this subject in the AMERICAN NATURALIST for May contains a hasty generalization, based upon pure assumption, or upon insufficient data, and supported only by a false analogy. It opens with the startling proposition that "it is a well known law in the animal kingdom, that the young or embryonic state of the higher orders of animals resemble (*sic*) the full-grown animals of the lower orders." If such a law had ever been discovered to exist, the tadpole and the caterpillar, which are cited in proof, would certainly be good illustrations of it. But this statement is so far from being "a well known law," or "one of the causes of the recent rapid progress in the study of the animal kingdom," that no eminent living naturalist or biologist recognizes the existence of such a law; or at least no one of them gives a hint of it in his writings.

Agassiz claimed that ancient animals resembled the embryos of recent animals of the same class, and that the geological succession of extinct forms is parallel with the embryological development of existing forms. But if this principle be true, it is far from meeting the requirements of the "law" of this article.

The writer of it may have had in his mind a vague idea of the law of Von Baer, which *is* well known, and which *has* enabled naturalists "to correct their systems of classification," viz.: "That, in its earliest stages, every organism has the greatest number of characters in common with all other organisms, *in their earliest stages*." Or, to put it in language parallel to that of the "law" of this article, false syntax excepted; the embryonic state of the higher orders of animals resembles *the embryonic* (not the full grown) *state* of the lower orders. The germ of a human being differs in no visible respect from the germ of every animal and plant: it never resembles any full grown animal or plant. It successively looses its resemblance to vegetable embryos, then to all embryos but those of Vertebrates, then to all but those of Mammals. Finally it resembles only the embryos of its own order, Primates; and at birth the infant is like the infants of all human races.[1] But never at any period of its successive differentiations

[1] See Spencer's Biology, Vol. I.

does it resemble the *adult form* of fish, reptile, bird, beast, or monkey.

The principle stated is not a law of the animal kingdom. If it be a law at all, it is a newly discovered one, and applies only to the vegetable kingdom.

The proposition to be established then is, that the young or embryonic state of the higher orders of plants resembles the full grown plants of the lower orders. The writer finds his first proof in a comparison of the fovillæ of a pollen grain with full grown Desmidiæ. The points of resemblance are these: both are minute; each consists of a single cell; and both have an apparently aimless motion. Surely, these resemblances are not numerous or striking enough to found a law upon; and if they were, they have not the remotest bearing upon the supposed law. Admitting that the fovillæ "may be regarded as one of the first steps towards the reproduction of plants of the highest type," yet they are not in any sense a *young or embryonic form* of a plant. The fovillæ constitute the male element, and are homologous, not to the *embryo*, but to the *spermatozoa* of animals. The supposed analogy between a Protococcus and a pollen grain is open to the same criticism. Nor is the correspondence between a full grown Botrydium and a pollen tube of greater value. A pollen tube cannot, in any legitimate sense, be called embryonic. The superficial resemblance of a mould fungus to a stamen, is obvious enough; but in reality no analogy can exist between them. The spores of the mould are embryos, and will develop, under favorable circumstances, into mould again. But pollen grains are not embryos, and never, under any circumstances, grow into what, by any stretch of terms, can be called a new plant. Neither stamens nor pollen constitute a part of the embryo; and no analogy drawn from them can have any bearing upon the laws of embryonic development. If such a law as the writer claims really exist, it must be found by studying the development of the *ovule*, the true homologue of the animal embryo. In view of such facts, all "similar analogies" and all similar "proofs of the unity of design of the Creator" may be easily dispensed with.

The article proposes to extend the domain of a certain supposed law of the animal kingdom, so as to include the vegetable kingdom also. It has been shown, First, that no such law exists in the animal kingdom; Second, that not a single fact cited as prov-

ing it to be a law of the vegetable kingdom has the remotest bearing upon the question. If such hasty conclusions as these, wildly jumped at from no data, are to be allowed under the name of Science, her students will richly deserve all the ridicule and sarcasm which a certain class are so fond of pouring upon them.— CHAS. R. DRYER, *Phelps, Ontario County, N. Y., May* 12, 1875.

COREOPSIS DISCOIDEA SPONTANEOUS IN CONNECTICUT. — Adjoining our cow-pasture is a piece of woodland of about four acres, with beech, birch, chestnut, oaks, etc., growing on it. It is level but has several depressions which form shallow ponds containing water most of the year. In one of these, about a hundred paces in circuit, grow button-bush, wild-rose sedges, cotton-grass, sphagnum, grasses, at least three species of Bidens or beggar-ticks and *Coreopsis discoidea*. I gathered flowers of the last when just coming into blossom, supposing it to be the common beggar-ticks, at the same time noticing its slender, delicate habit, so unlike the coarse weed of our fields. But, on examining the young ovaries, I could see no sign of the retrorse bristles on their awns, which the achenia of Bidens should have. I thought this might be owing to their immature state. Moreover, on comparing it with Coreopsis, I found it to agree with *C. discoidea* in everything except the *reflexed* outer involucre which an old edition of Prof. Gray's Botany assigned to it. I sent a bit of it to him and he pronounced it *C. discoidea*.

Just after this, I found, in the same place, a plant, very much like the former ones, which had unmistakably the achenia of *Bidens frondosa*, the ciliated outer involucral leaflets of the same, the flower heads just perceptibly larger than those of the Coreopsis, and the same delicate growth of the latter.

In the last edition of Prof. Gray's manual, he gives as one character of the subsection * * * * "scales of the outer involucre reflexed *or* spreading" without indicating to *which* of the four species the *reflexed* involucre belongs. I did not observe any such in the plants I gathered. The awns did not seem to me "*stout*" and they were merely hispid rather than "upwardly barbed."— CHARLES WRIGHT, *Wethersfield, Conn.*

FERTILIZATION OF ALPINE FLOWERS BY BUTTERFLIES. — In the ninth of a series of valuable papers communicated by Hermann Müller, to "Nature," on the fertilization of flowers by insects, he

shows that butterflies effect the cross-fertilization of Alpine orchids. It seems that from twelve to fifteen per cent. of the orchids of the lowlands are fertilized by Lepidoptera, while from sixty to eighty per cent. of Alpine orchids are fertilized by the same kind of insects. This corroborates, he says, his view that the predominant frequency of butterflies in the Alpine region must have influenced the adaptation of Alpine flowers.

Müller has also shown the wonderful modifications brought about in the legs and mouth-parts of bees by their efforts in fertilizing flowers.

ZOOLOGY.

On the Development of the Nervous System in Limulus.[1] — After a good many unsuccessful attempts at discovering the first indications of the nervous system in the embryo of Limulus, I at length, in making fine sections, with the aid of the skill of Prof. T. D. Biscoe, discovered it in a transverse section of an embryo in an early stage of development, corresponding to that figured on plate iv, fig. 10, of my essay on the Development of *Limulus Polyphemus* in the Memoirs of the Boston Society of Natural History. The period at which it was first observable was posterior to the first blastodermic moult, and before the appearance of the rudiments of the limbs. The primitive band now surrounds the yolk, being much thicker on one side of the egg than on the other, the limbs budding out from this disk-like thickened portion which represents the outer or nervous layer of the germ. At the time the nervous cord was observed it was entirely differentiated from the nervous layer proper, and in section and relation to the nervous layer appeared much as in Kowalevsky's figure (33) of the germ of Hydrophilus (Embryologische Studien an Würmen und Arthropoden, 1871).

At a later stage in the embryo, represented by Pl. V, fig. 16 in my Memoir, at a period when the body is divided into a head and abdomen, and the limbs are longer than before, by a series of sections parallel with the under surface of the body, I could make out quite satisfactorily the general form of the main nervous cord. It then forms a broad thick mass, the two cords being united, with small holes between the cords opposite the sutures between the segments and situated between the primitive ganglionic centres.

[1] Read at the November (1874) Meeting of the National Academy of Sciences.

The nervous cord, as in the Acarina, is formed long before the other internal systems of organs; the development of the dorsal vessel some time after succeeding that of the nervous cord, while the alimentary canal is not formed until some time after the larva is hatched.

The next stage observed, and one of exceeding interest, was studied in longitudinal sections of the larval Limulus. If we make a longitudinal section of the young king crab when a little over an inch long, the disposition of the cephalothoracic portion of the cord is exactly as in the full-grown individuals. The nervous ganglia are then united into a continuous nervous collar surrounding the œsophagus, no ganglionic enlargements being observed, the collar in fact consisting entirely of ganglia, the commissures being obsolete; in front of the œsophagus and in the same plane as the œsophageal collar lies the supraœsophageal-ganglion, or so-called brain; not as usual in the normal crustacea, raised above the mouth into the roof of the head. On the contrary, the œsophagus passes behind the brain and through the collar at a right angle to the plane of the œsophageal collar and brain taken collectively. Now a section of the larva before moulting shows a most important and interesting difference as regards the ganglia which supply nerves to the appendages of the cephalothorax. These are entirely separate, the spaces between them, where they are connected by commissures, being as wide as the ganglia themselves are thick. Five ganglia were observed corresponding to five anterior pairs of members. It is probably not until after the first moult at least that the adult form of the nervous cord is attained.

Some interesting questions in the morphology of Limulus arise in connection with this discovery of the original separation of the ganglia of the head, which I will simply touch upon. The brain of Limulus differs remarkably from that of the normal crustacea, *i. e.*, the Decapods, in sending off no antennal nerves, but only two pairs of optic nerves, there being in fact in Limulus no antennæ. In the spiders and scorpion the disposition of the nervous system only resembles that of Limulus in the thoracic and cephalic ganglia being somewhat consolidated, but the brain is situated far above the plane of the thoracic mass, and the commissures are very long, and here also there are no antennal nerves, no antennæ being present, but a pair of nerves are distributed to the mandi-

bles. The general analogy in the form of the anterior portion of the nervous cord to the Arachnidan, by no means proves satisfactorily to my mind that the Limulus and Merostomata generally are Arachnida, as some authors insist, for, besides the remarkable difference in the form and position of the supraœsophageal ganglion above mentioned, there are other differences of much importance, which separate the Merostomata from both the Arachnida on the one hand, and the Crustacea on the other.

It will now be a matter of interest to study the development of the nervous cord in the Arachnida, at the stage where the cephalothoracic ganglia are separate and compare them with the same stage in Limulus.

The result may possibly show that the appendages of the anterior region of Limulus are in fact cephalic appendages or mandibles and maxillæ or maxillipeds, and in part truly thoracic; as in the spiders and scorpions the nerves to the maxillæ and legs are distributed from a common cephalothoracic mass of concentrated ganglia. — A. S. Packard, Jr.

The Pine Snake. — As having some relation to the animosity which this reptile is supposed by the old residents of the Pines to bear towards the rattlesnake, I find an important observation which I have made, not mentioned in the article of the January number of the Naturalist. As there noted, the Pine Snake, when alarmed or enraged, slowly inflates itself with air, thus nearly doubling its normal size along its entire length, except the tail. It then slowly expels the air with its own peculiar sound. While thus blowing in anger, the tail is made to perform a singular part in this manifestation of rage. The horny tip, or four-sided spike, is slightly elevated, and caused to vibrate with such rapidity as to produce a little fan of light, about an inch in length. Were this quadrangular spike a little flattened and constricted at intervals, and raised a little higher when set in vibration, we should have, with its buttons and functions, the true organ of the dreaded rattlesnake (*Crotalus horridus*). The sight of this in motion is certainly suggestive of the tail of a Crotalus in rudiment. If the tradition of the Pine Snake's enmity to the rattlesnake be true, it would not be the first instance of disagreement between relations.

In this connection may be mentioned our reading a slip from a

western paper, in which was stated that one of our large innoxious snakes was killed, which had swallowed a rattlesnake, except the tail, which with its rattles projected from the mouth. The statement lacked the mention of names, thus affording no clue for a proper inquiry into the facts of the case.

The old residents of the Pines say that the Pine Snake will follow a person, but that if you approach the reptile, it will at once turn to escape. This habit, indicating inquisitiveness and timidity, Mrs. Mary Treat informs me that she has herself witnessed, in the woods at May's Landing, N. J.

I have received statements from long residents which make it highly probable that the Pine Snake lays its eggs in the sandy soil, where it is dry, and of course somewhat higher than the swamps and streams. Also, I believe that the skunk (*Mephitis chinga*) has much to do with keeping down the increase of *Pituophis*, it being, in the Pines of New Jersey, somewhat expert in finding, and voracious in devouring the eggs of this snake.

Desirous to know whether the Pine Snake does carry the vindictiveness towards the rattlesnake imputed to it, and any other facts that might help to a knowledge of the life-history of the species, I would be glad to see notes on this subject contributed to the NATURALIST, either directly, or through the present writer.—SAMUEL LOCKWOOD, *Freehold, N. J.*

A LITERARY GEM.—In that comedy of errors which one C. G. Giebel caused to be printed under the title of *Thesaurus Ornithologiæ*—that treasury of blunders—it is hard to select the champion error. But the gem of this precious collection is perhaps at p. 96, where we read:—"LINING, J., extract of a letter with his answers to several queries sent to him concerning his experiments of electricity with a kite (Falco).—*Philos. Transact.* 1755, xlviii, 757."

Shade of Ben. Franklin!—with a kite!!—Falco!!! Why did not the accurate and scholarly Giebel say *Falco longicaudatus*—for the kind of "kites" referred to, as every little boy knows, have several yards of tail! This ornithological item is given under head of "Anatomy and Physiology." We sighed, and mechanically turned the leaves back to look under "B" for *Burton's Anatomy of Melancholy*, but the inconsistent Giebel had overlooked this; perhaps he thought his book sad enough already. We beg

to respectfully suggest the following ornithological titles for his next edition :—

THACKERAY, W. M. Adventures of Timothy Titmarsh (*Parus palustris*).

HUSBAND, A. Letter to his Little Duck (*Anas*) of a Wife (*sponsa*), enquiring whether the Baby is still a Creeper (*Certhia*). [N. B. If Dr. Giebel should be in doubt under which one of his xxxiii headings this title should come, he might put it under "Propagatio" or under "Monographs of Families."]

POLICEMAN, A. On the Jayl-birds (*Garrulus*) and Gutter-snipes (*Scolopax gutturalis*) of the metropolis; or, how to go on a Lark (Alauda).

GIEBEL, C. G. Ornithological evidences of Lunacy (Loon-icy, *Colymbus glacialis*).

THE EUROPEAN CABBAGE BUTTERFLY probably made its appearance in the neighborhood of Cleaveland, Ohio, during the season of 1873, but its ravages did not attract special attention till the summer of 1874, when many thousands of dollars were lost by the wholesale destruction of cabbages and cauliflowers in this section. We have also received notice of similar devastation among these plants in Western Pennsylvania (1874), probably caused by the larvæ of this same insect pest. Fortunately for the vegetable gardeners, however, the active European parasite of the *Pieris* is also on hand, and scarcely less than ninety per cent. of last year's cocoons are now found more or less completely filled with individuals of the bronzen ichneumon-fly known as *Pteromalus puparum*, either in the larval or pupa state. — T. B. COMSTOCK.

THE LARK BUNTING. — While with the Yellowstone Expedition of 1873, under Gen. Stanley, I collected some material, amongst which was a nest of the Lark bunting, *Calamospiza bicolor* Bonap.), containing three eggs of the same, with one parasitic egg, which I have every reason to believe was that of the Crow Black bird (*Molothrus pecoris* Swainson), as I am well acquainted with the eggs of this bird, and also, because it was found at the same localities, where the Lark bunting seemed to settle. The nests of the latter were generally found at the head-waters of the various streams running either into the Heart or Big Knife Rivers, in fact so close to the springs that in many places the ground was moist. The nests which I found were generally under or amongst tufts of grass, or other shrubs of a stunted

character. Mr. Allen, who accompanied us, has probably described the nests and eggs, ere this, so I will not go into details. —W. HOFFMAN, M.D.

GEOLOGY AND PALEONTOLOGY.

ON THE ORDER AMBLYPODA. — Prof. Cope recently read a paper on the structure of the feet of Bathmodon, showing that they resembled in many points those of the Elephants but differed in others. He finds five toes on each foot, which are very short and furnished with small transverse hoofs. The bones of the carpus resemble closely those of Toxodontia. In the hind foot the arrangement is like that of the Elephants except that the navicular bone is withdrawn to the outer side so as to bring the cuboid and one cuneiform bone into contact with the astragalus. On the characters thus ascertained he based the definition of a new order of mammals. The *Amblypoda* which presents two sub-orders, the Pantodonta represented by Bathmodon, and the Dinocerata represented by Uintatherium.

ANTHROPOLOGY.

PERFORATION OF THE HUMERUS CONJOINED WITH PLATYCNEMISM. —Associated with that extreme development of platycnemism discovered by the writer, some years ago, in the ancient mounds on the Detroit and Rouge Rivers, Michigan, he has found the perforation of the humerus. Allusion is made to that peculiarity of the arm bone in which is presented a communication of the two fossæ at its lower end. It is difficult to arrive at the exact amount of the percentage to which this prevails in these mounds; though there can be little doubt that at least 50 per cent. of the humeri have this characteristic. This is of interest as being in excess of that from the mounds in other parts of the country, where it is calculated as being only 31 per cent. It is a characteristic which, significantly enough, exists in the ape, pertains to the negro in a large degree, while it is very rarely encountered in any of the white races.

In a letter received last year from Prof. Busk, F. R. S., he attaches importance to the writer's discovery of this conformation of the humerus being a peculiarity of platycnemic man, and states

that he does not think such a coincidence has been noticed elsewhere. At any rate it has not been so absolutely established heretofore.

Transitional states of the characteristic, if they may be so called, are also seen in the Rouge River mound; that is, instances in which the communication between the fossæ is not quite completed, the dividing wall being reduced, in some cases to a very thin partition, almost transparent. Even where the perforation is accomplished, there is a great variation in the size of the aperture. — HENRY GILLMAN, *Detroit, Michigan.*

MICROSCOPY.

ATLAS DER DIATOMACEEN KUNDE.— By Adolf Schmidt, assisted by Gründler, Grunow, Janesch, Weissflog and Witt. Publishing in parts, each with four plates. To be completed in from twenty-five to thirty parts. Three parts of this magnificent work have been received. Each plate contains from fifteen to forty figures. The plates are from photographs of original drawings, reproduced by some one of the processes for copying photographs. It is said that nine thousand drawings have been prepared for the work. Size of the plates, fourteen by nine and one-half inches.

It seems to be the aim of the editors to give every known variation of each species of Diatom. For example, plate seven has forty variations of the type, *Navicula Smithii* Breb. = *N. elliptica* W. S. Other genera and species are treated in the same manner. Two plates with eighty-nine figures are devoted entirely to the panduriform Navicula. The editors are the most renowned students of this department of natural history in Germany, and the work will be indispensable to all workers in this country, to whom the writings of the German diatomists have been almost inaccessible, scattered as they are among the German periodicals, while for the bibliomaniac it will supply one of the great books of the age. — C. S.

MEASUREMENT OF MÖLLER'S PROBE PLATTE.[1] — *Mr. A. F. Dod, Secretary of the Memphis Microscopical Society, Memphis, Tennessee. Dear Sir:* I have this day finished the measurement of your probe-platte, No. 586. The first thirteen were measured on the evening of March twenty-ninth, by lamp-light; the rest

[1] Read before the Memphis Microscopical Society, April 15, 1875.

were measured, and the thirteenth was remeasured this morning by sunlight. A heliostat was used to give a steady beam of light, and blue glass to make it monochromatic. The index error of the cobweb micrometer was redetermined for the occasion; three observations gave $\frac{9}{97}$, $\frac{9}{96}$, $\frac{9}{96}$, revolutions respectively. This correction was applied in all the calculations. All measurements were repeated; all the striæ measured were counted at least twice. In the first five diatoms, as is well known, the striæ are not of uniform fineness all over the surface of the frustule; in these, one of the measurements is made at the *coarsest* striation which was noticed on the frustule; and another was made on the *same striæ*, but at the point where they converge nearest to each other. Care was taken not to be deceived by spectral lines. An immersion sixteenth, by Tolles, having a maximum angle of 178 degrees, was used in all the measurements:

1.	Triceratium favus,	.	.	.	.	6	counted	3.63	in 1-1000	inch.
2.	" "	.	.	.	.	5	"	3.76	" "	"
3.	Pinnularia nobilis,	.	.	.	.	16	"	13.1	" "	"
4.	" "	.	.	.	.	15	"	12.4	" "	"
5.	Navicula lyra,	.	.	.	.	23	"	17.1	" "	"
6.	" "	.	.	.	.	20	"	15.2	" "	"
7.	" "	.	.	.	.	21	"	16.6	" "	"
8.	" "	.	.	.	.	32	"	25.1	" "	"
9.	" "	.	.	.	.	26	"	23.9	" "	"
10.	Pinnularia interrupta,	.	.	.	.	18	"	26.7	" "	"
11.	" "	.	.	.	.	17	"	25.1	" "	"
12.	Stauroneis phoenicenteron,	.	.			32	"	34.6	" "	"
13.	" "	.	.			32	"	34.5	" "	"
14.	Grammatophora marina,	.	.	.		38	"	38.4	" "	"
15.	" "	.	.	.		27	"	38.4	" "	"
16.	Pleurosigma balticum,	.	.	.		37	"	33.1	" "	"
17.	" "	.	.	.		33	"	33.1	" "	"
18.	Pleurosigma acuminatum,	.	.			40	"	46.3	" "	"
19.	" "	.	.	.		25	"	46.6	" "	"
20.	Nitschia amphioxys,	.	.	.		34	"	49.2	" "	"
21.	" "	.	.	.		28	"	49.3	" "	"
22.	Pleurosigma angulatum,	.	.			28	"	46.8	" "	"
23.	" "	.	.	.		24	"	47.1	" "	"
24.	Grammatophora oceanica,	.	.			39	"	61.5	" "	"
25.	" "	.	.	.		27	"	61.9	" "	"
26.	Surirella gemma; transverse striæ,					45	"	53.2	" "	"
27.	" "	.	.	.	.	35	"	52.8	" "	"
28.	" "	.	.	.	.	35	"	54.6	" "	"
29.	" "	.	.	.	.	34	"	53.0	" "	"
30.	" "	.	.	.	.	21	"	53.8	" "	"
31.	" "	.	.	.	.	21	"	53.8	" "	"
32.	Nitschia sigmoidea,	.	.	.		37	"	61.9	" "	"
33.	" "	.	.	.	.	41	"	62.0	" "	"
34.	" "	.	.	.	.	49	"	62.5	" "	"
35.	Pleurosigma fasciola,	.	.	.		20	"	57.8	" "	"

36.	Pleurosigma fasciola,	.	.	.	17	counted	58.2	in 1-1000	inch.
37.	Surirella gemma; longitudinal striæ,				22	"	66.9	" "	"
38.	" "	.	.	.	13	"	67.3	" "	"
39.	Cymatipleura elliptica,	.	.	.	34	"	63.0	" "	"
40.	" "	.	.	.	38	"	63.1	" "	"
41.	Navicula crassinervis,	.	.	.	31	"	86.2	" "	"
42.	" "	.	.	.	22	"	86.2	" "	"
43.	Nitschia curvula,	.	.	.	29	"	90.1	" "	"
44.	" "	.	.	.	26	"	89.8	" "	"
45.	Amphipleura pellucida,	.	.	.	30	"	93.4	" "	"
46.	" "	.	.	.	17	"	96.1	" "	"
47.	" "	.	.	.	23	"	96.0	" "	"
48.	" "	.	.	.	27	"	95.3	" "	"

In case you should at any time require it, I can specify more in detail what part of each frustule was subjected to measurement. I have given all the observations in order that by comparing them, you may see, in the case of the coarse diatoms which are very easy to measure, the amount of variation in coarseness on the same frustule; and, in case of the finer, which more easily admit of some error in measurement, the degree of accuracy shown by the accordance of different observations.

It is not till I shall have measured several copies of Moeller's probe-platte, that it will be proper or worth while to make any detailed comparisons of the results. It may, however, be remarked that the two specimens of *T. fæus* differ as much as nineteen or twenty per cent. Two vary from fifteen to twenty per cent; two vary from ten to fifteen per cent; six vary from five to ten per cent; ten vary less than five per cent; as compared with my probe-platte. The average variation between the measurements of the corresponding diatoms of the two plates is six and nine-tenths per cent; the average of all the variations shows your platte to have its frustules five per cent. finer than mine. The samples of *Amphipleura pellucida* on the two plates agree within three and two-tenths per cent.—*Very truly yours*, EDWARD W. MORLEY, *Hudson, O., April* 10, 1875.

AMERICAN ASSOCIATION.—A full representation of those interested in the microscope is especially desirable at the Detroit meeting of the A. A. A. S., commencing on the 11th of next August, as it is desired to take steps toward the organization of a Microscopical Society, either as a separate society or club, or as a subsection of the large Association. There is a very general desire for a society of American microscopists, and it is believed that such a society can obtain general attendance from the whole

country only at the time and place of meeting of the A. A. A. S., to say nothing of the other very great advantages of meeting in connection with that prominent organization.

NOTES.

The Boston Daily Advertiser, in a recent criticism on the "Statement of the Theory of Education in the United States of America," a pamphlet issued by the Bureau of Education in Washington, offers the following forcible remarks, which illustrate very fairly how favorably the educational ideas of our best scientific men are received by the intelligent part of the community:

"Another point hinted at by the pamphlet is the excessive regard paid to the text-book. The general system of instruction lays special emphasis on the use of text-books, and the prevalent tendency is toward giving the pupil an initiation into the method of using the printed page in the form of books and periodicals for the purpose of obtaining information from the recorded experience of his fellow-men, but in many schools and systems of schools, equal or greater stress is laid upon the practical method of conducting investigations for the purpose of verification and of original discovery. We presume that the last clause, though rather obscure, points at object lessons, field study and the use of the laboratory, but the words employed elsewhere, "the prevailing custom in American schools is to place a book in the hands of the child when he first enters school, and to begin his instruction with teaching him how to read," sufficiently express the fundamental notion of practical education as it prevails in America. The omission, on the one hand, of a public Kindergarten as initiatory, and the close succession of text-books in every department of study, expose one evil in our system which is not likely to be eradicated by any formal enactment or introduction of new systems, but only by the gradual emancipation of the human mind from its present subjection to the printing-press. The extent to which the present system is carried is appalling when we consider it fairly. The teacher is in danger of being buried under the accumulation of text-books; not only the whole field of experimental science is still largely in bondage to the printed page, but the whole field of scientific observation is in danger of being cultivated through the medium of text-books which do not tend to lead the young student to nature, but offer themselves as a substitute for nature. We look indeed to natural science and natural history as the appointed means for freeing the human mind in this direction. The teacher who learns to instruct his classes by direct observation of nature will begin to apply the same principle in other departments of study. English literature, for example, will be taught less by

means of text-books about the subject than by direct contact with literature itself."

THE Bulletin of the U. S. Geological and Geographical Survey of the Territories, F. V. Hayden in charge (No. 4, second series, June 10, 1875), contains "Notes on the Surface Features of the Colorado or Front Range of the Rocky Mts.;" by F. V. Hayden, illustrated with fine panoramic views of the Colorado Mountains. "The Tertiary Physopoda of Colorado," by S. H. Scudder, and "Outlines of a Natural Arrangement of the Falconidæ," by Robert Ridgway, with numerous outline cuts. We have also received a "Preliminary Map of Central Colorado, showing the region surveyed in 1873–4," by Hayden's Geological and Geographical Survey of the Territories.

THE "Annual Record of Science and Industry for 1874," edited by Spencer F. Baird, with the assistance of eminent men of science, has recently been published by Harper & Brothers. It is a large 12mo of 665 pages. This annual has met with the approval of scientific as well as general students, and is the most reliable and convenient book of the sort published in the language. Several new features have been introduced, which make the present volume still more useful than its predecessors.

IN an article in the "American Journal of Science," for May, "On Dr. Koch's Evidence with regard to the Cotemporaneity of Man and the Mastodon in Missouri," Professor Dana, on a review of the evidence, thinks there is sufficient reason for regarding *Dr. Koch's* evidence *very doubtful*, but that future discoveries will establish man's contemporaneity with the mastodon, for he existed in Europe long before the extinction of the American mastodon.

SACHS' elaborate and comprehensive "Text-book of Botany, Morphological and Physiological, has been translated and annotated by Alfred W. Bennett, assisted by W. T. Thiselton Dyer, both excellent authorities. The work is published in sumptuous style by Messrs. Macmillan. Price $12.50. Received from A. A. Smith & Co., Salem. For sale by Lee & Shepard, Boston.

A VALUABLE, illustrated article on the Potato rot, by Professor W. G. Farlow, appears in the "Bulletin of the Bussey Institution," Part iv.